

Kobe II Bycatch Workshop Background Paper

SHARKS

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1. OVERVIEW

Sharks are an ancient and a highly diverse group of fishes presenting an array of issues and challenges for fisheries management and conservation due to their biological and ecological characteristics. Most sharks are apex predators, and many shark species are characterized by relatively late maturity, slow growth, and low reproductive rates. The combination of these characteristics makes sharks particularly vulnerable to overexploitation and their populations slow to rebuild.

A diversity of sharks are found within the convention areas of the five tuna RFMOs and are captured in artisanal, commercial, and recreational fisheries. As a result, all five tuna RFMOs experience shark bycatch in their respective tuna fisheries. In some cases, sharks are deliberately targeted, or at least considered to be economically valuable byproduct when captured in tuna fisheries. Some of the commonly caught species of shark within the tuna fisheries are the silky, blue, shortfin mako, porbeagle, and oceanic whitetip and hammerheads. In most cases, a general lack of data on shark catch, abundance, distribution, life history (e.g., age, sex, growth, fecundity), and interactions within RFMO fisheries hinders an accurate estimation of shark bycatch levels and the associated population-level impacts. Moreover, in some regions, many shark species are captured at levels comparable to target species within the tuna RFMOs.

Shark bycatch has been discussed by all five tuna RFMOs, some seeking to address the problem for many years, particularly where sharks are characteristically caught in substantial numbers. For example, the IATTC started collecting shark bycatch statistics in 1992. ICCAT followed in 1995. In some cases, the fate of the sharks captured was not recorded until later, so some may have been released alive. Over the last few years, the retention of sharks (whole, not fins) has increased significantly. In 2008, the CCSBT adopted a recommendation requiring the use of conservation measures of other area-based RFMOs in relation to bycatch of sharks.

The information on catch and bycatch of sharks within the tuna RFMO fisheries has come, for the most part, from national at-sea observer programs as well as self-reporting logbook information. The level of detail on catches varies, but for the most part is incomplete or in some cases not reported at all. The limited data available is often not species-specific, although major efforts are being made to improve identification by observers, which adds to the difficulty of reliably estimating the amount of shark bycatch occurring and of differentiating it from any directed harvest. In order to reduce shark bycatch in all five tuna RFMOs, there must be greater emphasis on a comparable systematic collection of catch data at the species level by artisanal, commercial, and recreational fleets, considering the difficulty presented by the diversity of ways in which the sharks can be landed.

2. INFORMATION AND RESOURCES FOR ADDRESSING BYCATCH

2.1. Type and Characteristics of Fishery Interactions

The bycatch of sharks is known to occur in various longline, purse seine, and gillnet tuna fisheries. Pelagic sharks (such as the blue and shortfin mako shark) are targeted by longlines,

gillnets, handlines, rod and reel, trawls, trolls, and harpoons in the Atlantic Ocean, Gulf of Mexico, and Caribbean. They are mostly caught as bycatch in pelagic longline fisheries targeting tuna and swordfish. Total catch is probably underestimated due to misreporting of bycatches as well as the inadequate reporting of fisheries landing data. In the Pacific, four species of sharks interact with and are caught incidentally in the tuna purse seine fishery. The most common shark bycatch species include silky, whitetip, and hammerhead (mainly scalloped). The silky shark, oceanic whitetip shark, mako shark, and the blue shark are also taken in pelagic longline fisheries in the eastern Pacific and are taken in artisanal fisheries in many countries around the eastern Pacific. In the western Pacific, pelagic sharks are a common bycatch of the WCPO longline and purse seine fisheries, but very few data have been collected at the species level to enable insights into their distribution and abundance. Observer data indicate that at least 16 shark species have been observed as bycatch in this longline fishery, and at least ten species have been observed as bycatch in the purse seine fishery. The blue shark is the most commonly caught species during commercial longline operations in the western Pacific.

The IATTC estimates that 43 percent of sharks caught by tuna purse seine vessels arrive on deck alive. The principal causes of death in purse seine fisheries are adverse conditions in the net resulting from the concentration of the catch, oxygen deprivation, stress, injuries, and the pressure to which the species are subjected in the brailer. It appears still, that certain species are more resistant than others to adverse conditions in the net, and are therefore more likely to survive, such as the oceanic whitetip shark.

2.2. Species Population Status

Given that shark populations caught in fisheries managed by the five tuna RFMOs are not, for the most part, managed directly by a total allowable catch system, there is a lack of priority on collecting catch data. As a result, very few comprehensive stock assessments have been completed. ICCAT has completed stock assessments for blue shark and shortfin mako and collaborated with the ICES on a joint porbeagle shark stock assessment. Some population modeling has been done of silky sharks in the eastern Pacific and for blue sharks in the North Pacific. The IATTC held a first ever Shark Stock Assessment Workshop in 2009. The workshop's focus was on identifying the current "state of play" in regards to available data for stock assessment purposes. Priority species for assessment were identified (e.g., silky sharks) and proceedings were tabled with suggested improvements for stock assessments.

While not providing information on the status of the stock (i.e., whether it is above or below overfished and overfishing thresholds), ERA has proven useful in providing information on those species most susceptible to pelagic fisheries. Some of the RFMOs are continuing to improve their data collection to allow for future stock assessments or ecological risk assessments.

The IUCN Red List of Threatened Species is recognized as a comprehensive, objective approach for evaluating the conservation status of plants and animals. The Red List currently classifies most of the pelagic sharks commonly caught in tuna RFMO fisheries as threatened or near threatened. A recent study to determine the global conservation status of 64 species of pelagic sharks and rays reveals that 32 percent are threatened with extinction, primarily due to overfishing, according to the IUCN criterion. Of 57 species of epipelagic sharks (0-200 m depth), 35 percent are face risk of extinction.

2.3. Species Distribution

As mentioned earlier, the distribution of sharks occurs across all five of the tuna RFMOs. Some pelagic shark species are transboundary in nature and can migrate great distances with some species crossing ocean basins, while others are more locally distributed. Due to their broad migratory patterns or seasonal distribution patterns, tuna fisheries interact with sharks globally.

However, providing accurate species distribution is hampered by the lack of adequate biological information and comparative programs within the RFMOs. Although more information is needed, many shark species found within one tuna RFMO's area are also found in that of another, offering an opportunity for joint stock assessment and bycatch estimation across the RFMOs. For example, oceanic whitetip sharks are a common, wide-ranging pelagic species found primarily in tropical waters worldwide with a range that could encompass portions of the IATTC and WCPFC in the Pacific Ocean. To this end, IATTC's scientific committee has recommended that management measures and data collection should be harmonized among all relevant RFMOs. In 2008 ICCAT adopted a non-binding resolution suggesting a joint meeting of adjacent RFMOs (ICCAT, ICES, NAFO, and NEAF) to examine the possibility of adopting compatible management measures for Atlantic porbeagle sharks.

Identification of species-specific habitats essential for different life stages, for example nursery areas, preferred foraging areas, or breeding grounds, may also help inform management if conservation action is needed at particular life stages. Studying shark distribution within different depths in the water column may also help to identify gears and fishing depths that could minimize shark bycatch. Some tagging programs developed by RFMO members have been conducted in recent years for various shark species. This available information is now helping to identify distribution patterns, as well as migratory movements, thus reducing the gap of information for some species of concern.

2.4. Fishery Impacts

In most cases, there is inadequate catch information available to reliably estimate the actual level of shark bycatch that is occurring within the tuna RFMOs. All five tuna RFMOs require their members to submit data on the bycatch of sharks, but the level of data submission varies greatly among them, and data are not typically reported at the species level. The limited information that does exist on shark bycatch has been provided by IATTC, ICCAT, ICES, NAFO, and WCPFC members. ICCAT requires members to submit catch and effort data for sharks, including estimates of dead discards and size frequencies. In recent years, the reported level of blue shark landings (both target and non-target catches) in ICCAT fisheries is over two times that of the landings of any of the tuna species, based on information derived from the shark fin trade. The IATTC has the most complete set of data on shark bycatch and. According to their information, tens of thousands of sharks are caught with more than three-quarters of these being taken in purse seine sets on FADs.

Although the quantity and quality of available data (e.g., historical catches and CPUE information) have increased in recent years, estimates of shark bycatch and overall stock status are still associated with high levels of uncertainty. This makes it difficult for RFMOs' scientific committees to provide quantitative advice with sufficient precision to guide fishery management toward optimum harvest levels, as well as for the RFMOs to adopt specific conservation measures. Nevertheless, given the generally recognized excess capacity issues facing many tuna fisheries, substantial levels of shark bycatch are consequence.

2.5. Bycatch Mitigation Measures

Before action can be taken to mitigate shark bycatch in fisheries, RFMOs must have sufficient information in hand to determine that a bycatch problem exists and to define the nature of the problem so that effective management actions can be adopted. ICCAT's scientific committee has recommended that countries initiate research projects to investigate means to minimize bycatch and discard mortality of sharks (e.g., with a particular view to recommending measures to minimize porbeagle bycatch in fisheries for tuna and tuna-like species). The IATTC approved a similar approach in a resolution approved in 2005 to promote the regional research cooperation between the RFMOs and nations participating in IATTC fisheries. It also limits the quantity of

shark fins that can be aboard, and at the same time, encourages the full utilization of any retained catches of sharks (all parts of the shark excepting head, guts, and skins) to the point of first landing. The IATTC also encourages the release of live sharks, especially juveniles, to the extent practicable, that are caught incidentally and are not used for food and/or subsistence purposes.

Even where data are limited, some of the tuna RFMOs are starting to explore mitigation methods to reduce the bycatch of sharks. For instance, the IOTC's Scientific Committee recently directed its Working Party on Ecosystems and Bycatch to look at possible ways of reducing shark bycatch in their longline fishery by looking at the use of monofilament trace rather than wire leaders. The IATTC started preliminary activities to develop attractors for sharks to remove them from the area to be encircled.

In some cases, RFMOs have determined that strategies to address shark bycatch can be tailored by species. For example, for species of high concern (in terms of overfishing), which are expected to have high rates of post-release survival, for example, the bigeye thresher, ICCAT's scientific committee recommended the prohibition of retention and landings to avoid fishing mortality. In response, ICCAT prohibited all retention of bigeye thresher sharks, with a limited exception for Mexico's coastal artisanal fishery, in 2009.

For shark species that are easily misidentified, other measures such as minimum landing lengths or maximum landing lengths would afford protection to juveniles or the breeding stock, respectively. Technical means of bycatch mitigation, such as systems to attract sharks out of the area to be encircled, gear modifications, training in handling techniques to improve survival of captured sharks, time/area restrictions, or the use of different types of bait, could offer alternative means of protecting different life stages. Additional information on these approaches could offer a useful resource for tuna RFMOs.

In addition to the work at the RFMOs, the FAO recently conducted an Expert Consultation to develop international guidelines on bycatch management and reduction of discards. The report of this meeting is anticipated for release later this year.

3. RESEARCH AND MANAGEMENT TOOLS

3.1. Research and Management Objectives

Clearly identifying and adopting priorities for research and management objectives can lead to more efficient and focused conservation action. A range of strategies for possible use in addressing bycatch of non-target shark species or juvenile sharks merit further investigation and include: 1) avoiding/closing areas where the ratio of shark bycatch/tuna catch is high; 2) modifying gear or fishing techniques to avoid hook-ups; and 3) releasing non-target or juvenile sharks in a manner that maximizes their post-release survivability. Additionally, gaining a better understanding of the survivability of caught sharks once released could greatly assist RFMOs in determining overall impacts of shark bycatch on populations.

Related to this, there are no widely-accepted protocols or best practices for safe handling and release of sharks. The development and adoption of such an agreed upon protocol might be of benefit, given the general perception that some shark species may be able to experience a certain level of careful post-capture handling without detrimental effects on release survivorship. ICCAT has directed its parties to conduct research on pelagic shark species, where possible, in order to identify potential nursery areas. ICCAT parties have also agreed to consider time and area closures based on this research, along with other management measures, as appropriate. In 2001, IATTC considered a measure to close fishing on floating objects in the area north of 7° North latitude to reduce silky shark bycatch.

In terms of management objectives, establishing a goal of either reducing bycatch to a certain

incidental catch rate or to a specified number of sharks caught, can clarify for RFMO members the direction and rationale for specific management action. At this time, no such objectives have been adopted by the tuna RFMOs.

3.2. Risk Assessment

ERA is a tool that can be used to evaluate the vulnerability of a stock to becoming over-fished, based on its biological productivity and susceptibility to the fishery or fisheries exploiting it. Its most practical use is to help management bodies identify the stock(s) that are most vulnerable to bycatch so that they can monitor and assess management measures to protect the viability of these stocks. Assessments have been considered by technical bodies in each of these organizations with a view toward developing conservation measures for reducing bycatch based on science and an ecosystem approach to fisheries management. Risk assessment methods for use in addressing bycatch continue to be improved, and the sharing of information between tuna and non-tuna RFMOs has furthered discussions of improving methodologies for future analyses. In particular, additional information on the productivity and susceptibility of individual species could enhance future risk assessments.

In 2008, ICCAT conducted ERAs for eleven species of sharks. The results indicate that bigeye threshers, shortfin mako, and longfin mako have the highest vulnerability, and lowest biological productivity, of the shark species examined, with bigeye thresher being substantially less productive than the other species. In conducting the assessments, ICCAT discovered challenges with respect to a lack of data and comparability for the data that did exist. Still, ICCAT used the results of these assessments to prioritize species for possible management action.

The IOTC plans to carry out an ERA for interactions between sharks (and seabirds) and IOTC tuna fisheries in 2011. Like ICCAT and the WCPFC, IOTC is considering working with other tuna RFMOs and IGOs with experience in risk assessment in order to identify efficiencies and to apply lessons learned. The CCSBT has not conducted an assessment of the global impact of the southern bluefin tuna fishery on sharks or other non-target taxa. Until recently, assessment work has been dominated by individual assessments of CCSBT members' bycatch. Recent attempts to produce scaled global estimates have been hindered by information compatibility issues and data limitations.

3.3. Monitoring and Reporting Schemes

At-sea observation of interactions between fishing operations and bycatch species is recognized as one of the most effective ways to collect information needed to assess and mitigate bycatch and for use in stock assessment work. While individual members with all five of the tuna RFMOs require onboard observer coverage in longline fisheries, RFMO-wide scientific observers are not required in the CCSBT, IATTC, or the IOTC. ICCAT requires 20% observer coverage for a portion of all vessels fishing for bluefin tuna regardless of gear type and 100% for all purse seine vessels over 24 meters in length. IATTC requires observers on all vessels larger than a certain size. The CCSBT fisheries are comprised of longline and purse seine gear and the CCSBT has a target observer coverage rate of 10%.

Effective observer programs must be able to monitor bycatch with sufficient levels of observer coverage to allow for relevant statistical analyses and data recording protocols, in part, to understand bycatch interactions (including identifying when and where interactions occur), document interaction rates, and provide a basis for fleet-wide extrapolations. These objectives determine the appropriate onboard observer coverage rate. As the five tuna RFMOs devise observer monitoring schemes that provide for the proper assessment of shark bycatch rates, the RFMOs may consider the IATTC's observer monitoring scheme for purse seine fisheries in the EPO which is likely the most detailed to assess shark bycatch. Without RFMO-wide observer

programs and data sharing and standardization across the RFMOs, there will continue to be a lack of data with adequate comparability and representativeness required for estimation of bycatch necessary for many wide-ranging bycatch species. Perhaps more importantly, tuna RFMOs without adequate observer coverage to provide an understanding the nature of interactions, may be unable to develop effective mitigation measures.

3.4. Periodic Review and Evaluation of Effectiveness

Periodic review and evaluation of management measures is critical to ensuring that the most effective practices are being employed and that decision-making adapts with the availability of new information. Review of adopted management measures can also be helpful in assessing potential changes to impacts on bycatch species as the characteristics and/or extent of a fishery changes, new fisheries develop, or new information becomes available. At this time, conservation measures in place within the IATTC and the WCPFC require periodic review of fin-to-body weight ratio and of implementation and effectiveness.

3.5. Education and Training

Education of fishermen can be useful to facilitate full compliance with any agreed-to conservation measures. Raising fishermen's awareness of the overall benefit to them and to bycatch species can improve usage of measures and can assist managers in identifying any difficulties with use by opening a constructive dialog with fishers about new requirements. Fishermen can also play a major role in developing and testing gear modifications. Many bycatch solutions involve relatively minor changes in gear and procedures, and usually a combination of technology and management is necessary to achieve the desired improvements.

CCSBT has developed a pamphlet on sharks in several different languages that it circulates to fishermen. ICCAT has also developed an identification guide to sharks for observers and for fishermen to assist in the collection of shark bycatch data in its fisheries. It has been translated into all ICCAT official languages. FAO has region-specific shark identification guides on its website that can be easily downloaded and provided to fishing industry. IATTC has also produced a shark identification guide and trains observers and fishermen on identification and safe release of sharks.

3.6. Independent Performance Review

Three of the five tuna RFMOs, CCSBT, ICCAT, and IOTC have complete independent performance reviews, as called for by the UN Fish Stocks Review Conference in 2006. In all three cases, the review panels noted the need for the RFMOs to make further progress toward the application of ecosystem-based consideration, such as the adoption of conservation and management measures for non-target species and species dependent on or associated with target stocks, including with respect to data collection requirements for the catch of non-target species.

For example, the ICCAT panel recommended that ICCAT members immediately take the management of shark fisheries and shark bycatch seriously and implement and comply with the ICCAT recommendations and resolutions to obtain accurate and reliable data. The IOTC review noted that the resolution adopted to address shark bycatch had only been partially implemented and specifically recommended that the list of shark species for which data collection is already required be expanded and that this requirement apply to all gear types.

3.7. Coordination with Other Relevant RFMOs and IGOs

The WCPFC initiated the development of MOUs with the CCSBT, IOTC, and IATTC to encourage collaboration between the respective organizations with respect to stocks and species of mutual concern, including conservation and management measures, collaboration on research efforts, and information sharing. These four MOUs are now in place. Since 1995, the ICCAT has

collaborated with the ICES Shark Study Group to exchange data and biological information on sharks. In particular, they jointly conducted a stock assessment for porbeagle sharks in the waters of the North Atlantic. Also, the CCSBT has adopted a recommendation that specifies compliance with IOTC and WCPFC measures concerning protection, as well as data collection and reporting of ecologically related species when fishing for southern bluefin tuna within those convention areas.

Outside of the tuna RFMOs, the FAO developed the IPOA-Sharks as a response to global concerns about the status of global shark populations. The objective of the IPOA-Sharks is to facilitate the conservation and management of sharks by, among other things, calling on nations to implement National Plans of Action for Sharks. Some nations have implemented NPOAs, to varying degrees of success. The CMS has prioritized the issue of bycatch of marine species in recent years, appointing a Scientific Councillor to coordinate the work of the CMS Scientific Council and the Convention on bycatch and strongly encouraging its members, through their participation at RFMOs, to raise the importance of bycatch, and encouraging RFMOs to share information regarding bycatch species of concern, including sharks, to the CMS. CMS also recently concluded negotiations of a global instrument addressing shark conservation and management. In February 2010, ten nations signed an MOU for migratory sharks. The MOU seeks to coordinate international action on the threats faced by sharks and work to improve their conservation and management. It explicitly encourages signatories to work collaboratively towards shark management, including through relevant RFMOs.

4. INVENTORY OF EXISTING CONSERVATION MEASURES

The table below provides an inventory of the conservation measures related to sharks currently in place at each of the five tuna RFMOs, demonstrating where they contain similar provisions and how they are different from one another. This table does not indicate the extent to which the measures are being implemented.

SHARKS					
	CCSBT	IATTC	ICCAT	IOTC	WCPFC
Provision	Recommendation to Mitigate the Impact on Ecologically Related Species of Fishing for Southern Bluefin Tuna	Resolution C-99-11, C-00-08, C-01-04; C-02-05, C-03-08, C-05-03 and C-04-05 (rev2)	Resolutions 95-02, 03-10, and 08-08, Recommendations 05-05, 04-10 and 06-10, and Supplementary Recommendations 07-06 and 09-07	Resolution 05/05, 08/01, 08/04, 10/12	Conservation and Management Measure 2009-04
4.1 Binding	No	Yes	Yes and no	Yes	Yes
4.2 Implement IPOA-sharks	Yes	Yes	No	No	Yes
4.3 Vessel applicability, area of application	No	Applies only to purse seine vessels	No	No	No
4.4 General prohibitions	No	No	Retention, transshipment, landing, storing, selling offering for sale, or targeting bigeye thresher	Retention, transshipment, landing, storing, selling offering for sale thresher sharks	No
4.5 Release, safe handling measures	CCSBT Recommendation adopts IOTC/WCPFC measures	Yes, especially juveniles not targeted, used for food and/or subsistence; use of techniques and equipment for rapid and safe release	Yes,, especially bigeye thresher and juveniles not targeted or used for food and/or subsistence; use of techniques and equipment for rapid and safe release	Yes, especially juveniles and pregnant sharks where not used for food and/or subsistence and thresher sharks.	Yes, encourage live release when not targeted and not used for food or other purposes
4.6 Interaction information collection and sharing	Yes, with IOTC and WCPFC requirements	Yes, annual reports on implementation and interactions	Yes, for catches by gear type, landings, catch effort, discards, biological parameters, and trade and for discards and releases for bigeye; to define areas and periods where likely to be caught, thresher for considering time-area closures	Yes, annually for catches and incidental catches and live releases of threshers	Yes, annually for catches of key species by gear type, including historical data and retained and discarded catches
4.7 Stock assessment	No	Yes, preliminary advice on status of key sharks and	Yes, for porbeagle, shortfin mako, and blue sharks for management		No

		propose research plan	advice		
4.8 Other research	No	Assess and reduce bycatch in purse-seine fishery; determine survival rates of released sharks; identify nursery areas; and define areas and periods most likely to be caught	Ecological Risk Assessments for 12 shark species Identify nursery areas, including for shortfin mako and blue	Yes, for threshers to identify potential nursery areas	Support research and development on strategies to avoid bycatch (e.g., chemical, magnetic, etc)
4.9 Report on implementation	Yes, annually	Yes, annually on catches, effort, landing, and trade	Yes, annually report on implementation of 04-10	No	Yes, on IPOA and assessment of need for NPOA, on measures to minimize waste and discards, and on any alternative measures used by States or artisanal fishers
4.10 Research and review of mitigation measures	Conduct risk assessments and consider how well these risks are mitigated by adopted measures	To make gear more selective	Yes, annually report on implementation of 04-10	To make gear more selective	Consider implementation and effectiveness of any alternative measures used by States or artisanal fishers
4.12 Retain, utilize	CCSBT Recommendation adopts IOTC/WCPFC measures	Full utilization of retained catches, as defined, and fins not more than 5% of total weight	Full utilization of retained catches, as defined, and fins not more than 5% of total weight	Full utilization of retained catches, as defined, and fins not more than 5% of total weight	Full utilization of retained catches, as defined, and fins not more than 5% of total weight
4.13 Estimate bycatch, assess impacts	Yes	No	No	No	No
4.14 Review for effectiveness and revision	Yes	Review fin-to-body weight by 2006	No	No	Periodic review of fin-to-body weight ratio and of implementation and effectiveness
4.15 Collection, use of observer data	Collection specified through CCSBT Observer Program Standards	For monitoring fins and carcasses when not offloaded together	Not explicit	For monitoring fins and carcasses when not offloaded together	For monitoring fins and carcasses when not offloaded together

4.16 Required compliance	Including with WCPFC and IOTC measures when fishing there	If not, no transshipment, landing, or trading	No	If not, no transshipment, landing, or trading	Yes
4.17 Consultation, cooperation with other RFMOs and IGOs	No	Preliminary advice on status of key stocks, propose comprehensive research plan in 2006, in cooperation with the WCPFC	Conduct joint ICES-ICCAT meeting to assess porbeagle, consideration of a joint meeting of the Chairs of the RFMOs in the Atlantic, provide to the FAO information to initiate a data collection program and so that it can coordinate RFMO data collection and activities, provide advice to CITES	No	Provide advice on status of key stocks, propose comprehensive research plan, in cooperation with the IATTC
4.18 Support for developing nations	No	Collection of data on catches	Consider assistance for the collection of shark data (04-10) Collection of data on catches of bigeye thresher	Collection of data on catches	IPOA implementation, data collection, on retained and discarded sharks
4.19 Consideration of Artisanal or Small-scale Fisheries		Excludes thresher shark measures	Rec. 09-07 Excludes Mexican small-scale coastal fishery with catch of less than 110 fish	Excludes artisanal fisheries which traditionally do not discard carcasses	Excludes traditional fishing activities and the rights of artisanal fishers to apply alternate measures

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